

-continued

## (2) INFORMATION FOR SEQ ID NO:13:

- (i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 33  
 (B) TYPE: nucleic acid  
 (C) STRANDEDNESS: single  
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:13:

TATTCGCTTA TTCATGATGA TCTTCCATCG ATG

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## (2) INFORMATION FOR SEQ ID NO:14:

- (i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 27  
 (B) TYPE: nucleic acid  
 (C) STRANDEDNESS: single  
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:14:

TTTACGCTTG TGCATGATGA TATTATG

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## We claim:

1. A mutant prenyl diphosphate synthase having a modified amino acid sequence, wherein

said mutant prenyl diphosphate synthase comprises an aspartic acid-rich domain having the sequence,  $D_1D_2X_1X_2(X_3X_4)D_3$ , in region II of said mutant prenyl diphosphate synthase.

wherein each of  $D_1$ ,  $D_2$  and  $D_3$  denote an aspartic acid residue;  $X_1$ ,  $X_2$ ,  $X_3$  and  $X_4$  are each independently any amino acid and  $X_3$  and  $X_4$  are each optionally independently present in the aspartic acid rich domain, and wherein

said mutant prenyl diphosphate synthase comprises (1) at least one amino acid substitution, said at least one amino acid substitution located at at least one amino acid position selected from (a) an amino acid between  $D_1$  and the amino acid residue at the fifth position upstream of  $D_1$  and (b) the amino acid residue located one amino acid position upstream of  $D_3$ ; (2) at least one additional amino acid inserted between  $D_3$  and the first amino acid upstream of  $D_3$ ; or a combination of (2) and (3);

wherein said mutant prenyl diphosphate synthase synthesizes prenyl diphosphate which is shorter than prenyl diphosphate synthesized by a corresponding wild-type enzyme.

2. A mutant prenyl diphosphate synthase according to claim 1 wherein said mutant has the enzymatic activities and thermo stability of wild type prenyl diphosphate synthase.

3. A mutant enzyme according to claim 1 wherein the reaction product of the prenyl diphosphate synthase is farnesyl diphosphate.

4. A mutant enzyme according to claim 1 wherein the prenyl diphosphate synthase is of the homodimer-type.

5. A mutant enzyme according to claim 1 wherein the prenyl diphosphate synthase is derived from archaea.

6. A mutant enzyme according to claim 1 wherein the prenyl diphosphate synthase is derived from *Sulfolobus acidocaldarius*.

7. A mutant enzyme according to claim 1 wherein the prenyl diphosphate synthase is a thermostable enzyme.

8. A mutant prenyl diphosphate synthase according to claim 1, wherein at least one amino acid selected from phenylalanine at position 77, threonine at position 78, valine at position 80, histidine at position 81, and isoleucine at position 84 has been substituted by another amino acid, or one or more amino acids have been inserted in between isoleucine at position 84 and methionine at position 85 in the geranylgeranyl diphosphate synthase as set forth in SEQ ID No: 1.

9. A mutant prenyl diphosphate synthase according to claim 1 wherein at least one amino acid selected from phenylalanine at position 77, threonine at position 78, valine at position 80, histidine at position 81, and isoleucine at position 84 has been substituted by another amino acid, and/or two amino acids have been inserted in between isoleucine at position 84 and methionine at position 85 in the geranylgeranyl diphosphate synthase as set forth in SEQ ID NO: 1, wherein the phenyl alanine at position 77 has been replaced with tyrosine, the threonine at position 78 has been replaced with phenylalanine or serine, the valine at position 80 has been replaced with isoleucine, the histidine at position 81 has been replaced with leucine or alanine, or the isoleucine at position 84 has been replaced with leucine; or proline and serine have been inserted in between the isoleucine at position 84 and the methionine at position 85.

10. A mutant prenyl diphosphate synthase according to claim 1, wherein the mutant prenyl diphosphate synthase is derived from a native geranylgeranyl diphosphate synthase of an organism selected from the group consisting of *Arabidopsis thaliana*, *Lupinus albus*, *Capsicum annuum*, *Sulfolobus acidocaldarius*, *Rhodobacter sphaeroides*, *Rhodobacter capsulatus*, *Erwinia herbicola*, *Myxococcus thaliana* and *Neurospora crassa*.

11. A DNA encoding an enzyme according to claim 1.

12. An RNA transcribed from a DNA according to claim 11.

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13. A recombinant vector comprising a DNA according to claim 11.

14. A host organism transformed with a recombinant vector according to claim 13.

15. A process for producing a mutant enzyme according to claim 1, said method comprising the steps of culturing a host transformed with an expression vector comprising a DNA coding for the mutant enzyme and of harvesting the expression product from the culture.

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16. A process for producing a prenyl diphosphate having not more than 15 carbons comprising the step of bringing an enzyme according to claim 1 or any of claims 2 to 10 or an enzyme produced by the method according to claim 15 into contact with a substrate selected from the group consisting of isopentenyl diphosphate, dimethylallyl diphosphate, and geranyl diphosphate.

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